FIG. 1

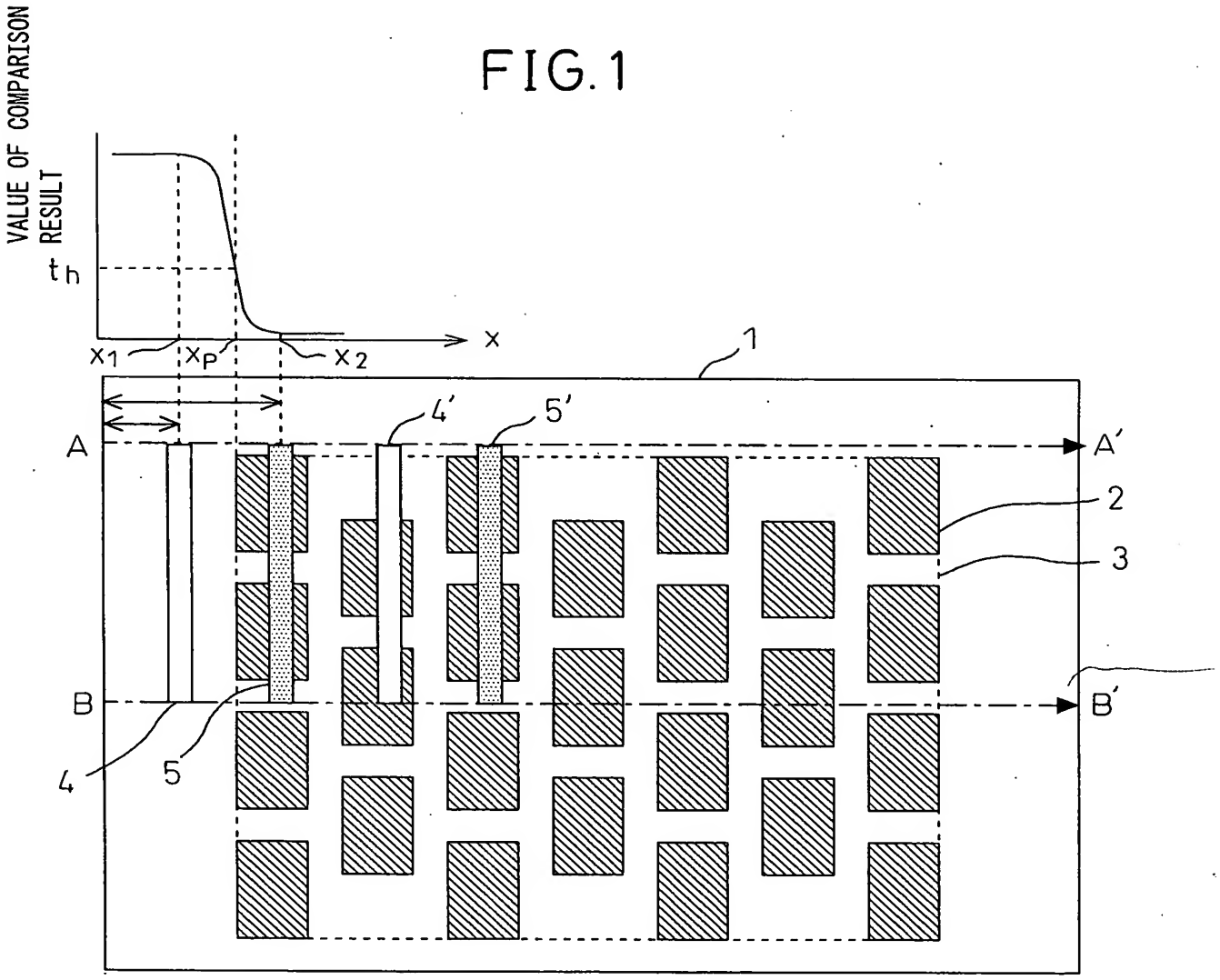


FIG. 2

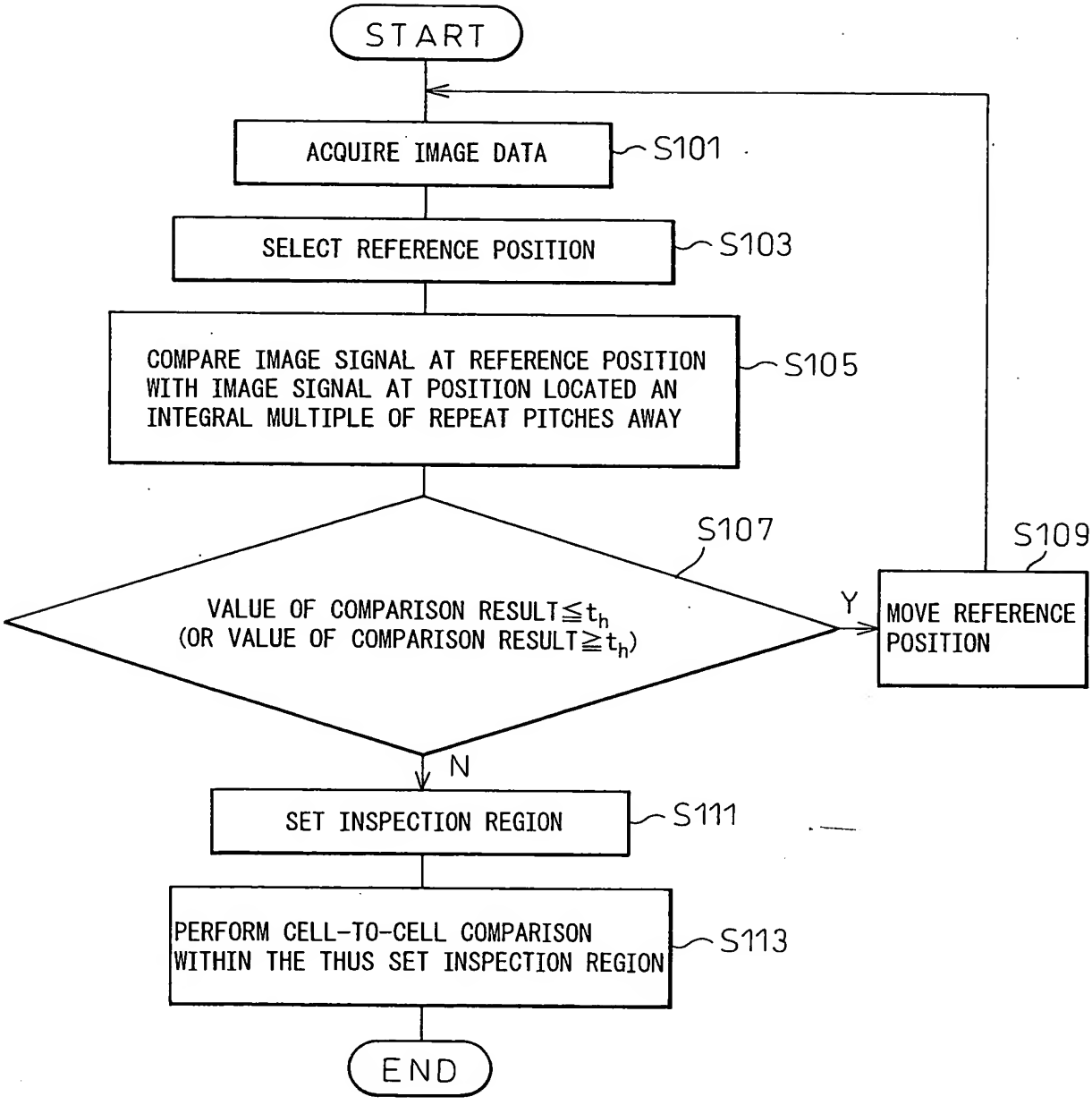

START
ACQUIRE IMAGE DATA
S101
SELECT REFERENCE POSITION
S103
COMPARE IMAGE SIGNAL AT REFERENCE POSITION WITH IMAGE SIGNAL AT POSITION LOCATED AN INTEGRAL MULTIPLE OF REPEAT PITCHES AWAY
S105
S107
VALUE OF COMPARISON RESULT≦t_h (OR VALUE OF COMPARISON RESULT≧t_h)
Y
S109
MOVE REFERENCE POSITION
N
SET INSPECTION REGION
S111
PERFORM CELL-TO-CELL COMPARISON WITHIN THE THUS SET INSPECTION REGION
S113
END

FIG. 3

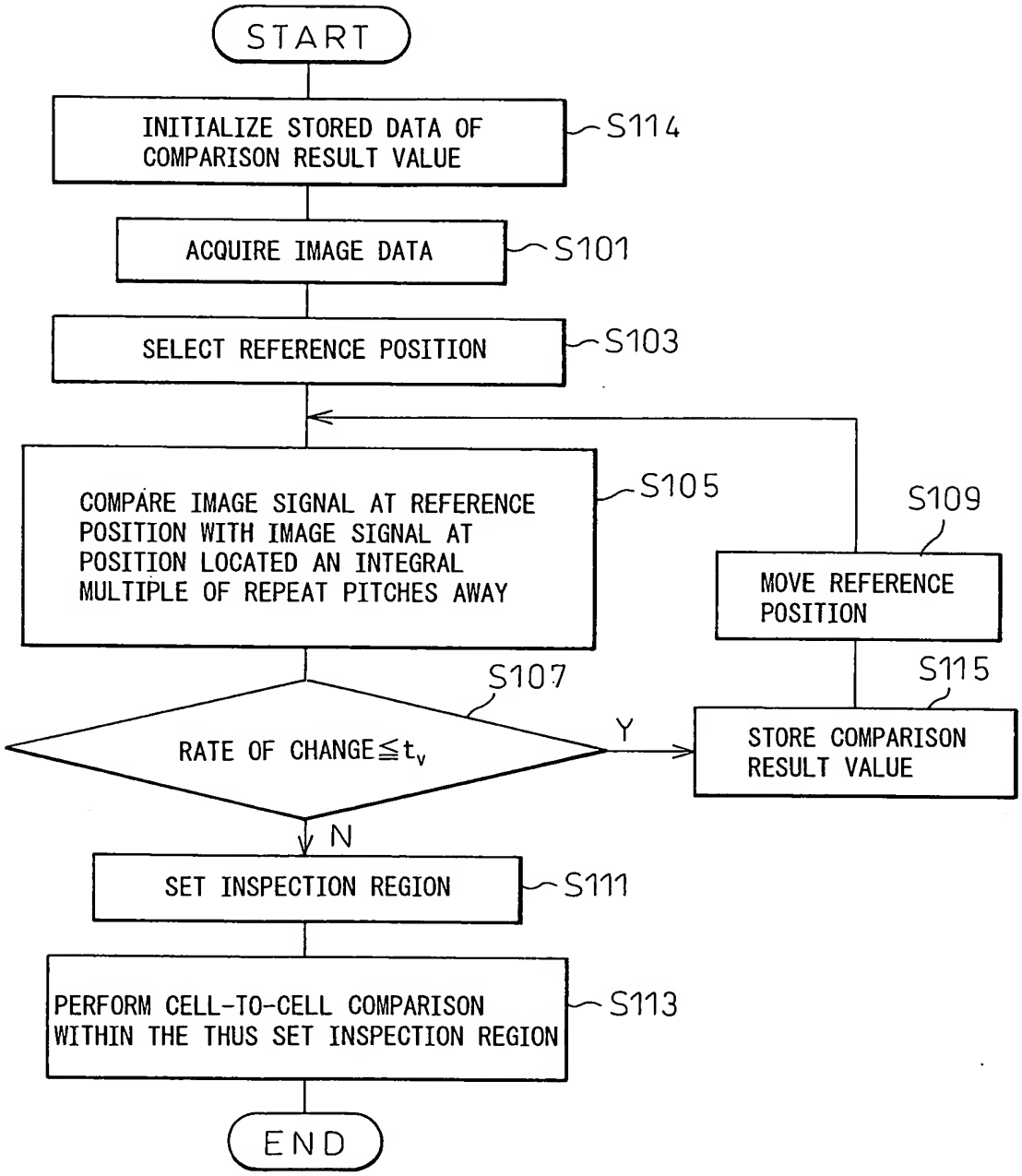

START
INITIALIZE STORED DATA OF COMPARISON RESULT VALUE
S114
ACQUIRE IMAGE DATA
S101
SELECT REFERENCE POSITION
S103
COMPARE IMAGE SIGNAL AT REFERENCE POSITION WITH IMAGE SIGNAL AT POSITION LOCATED AN INTEGRAL MULTIPLE OF REPEAT PITCHES AWAY
S105
S109
MOVE REFERENCE POSITION
S115
STORE COMPARISON RESULT VALUE
S107
RATE OF CHANGE≦t_v
Y
N
SET INSPECTION REGION
S111
PERFORM CELL-TO-CELL COMPARISON WITHIN THE THUS SET INSPECTION REGION
S113
END

FIG. 4

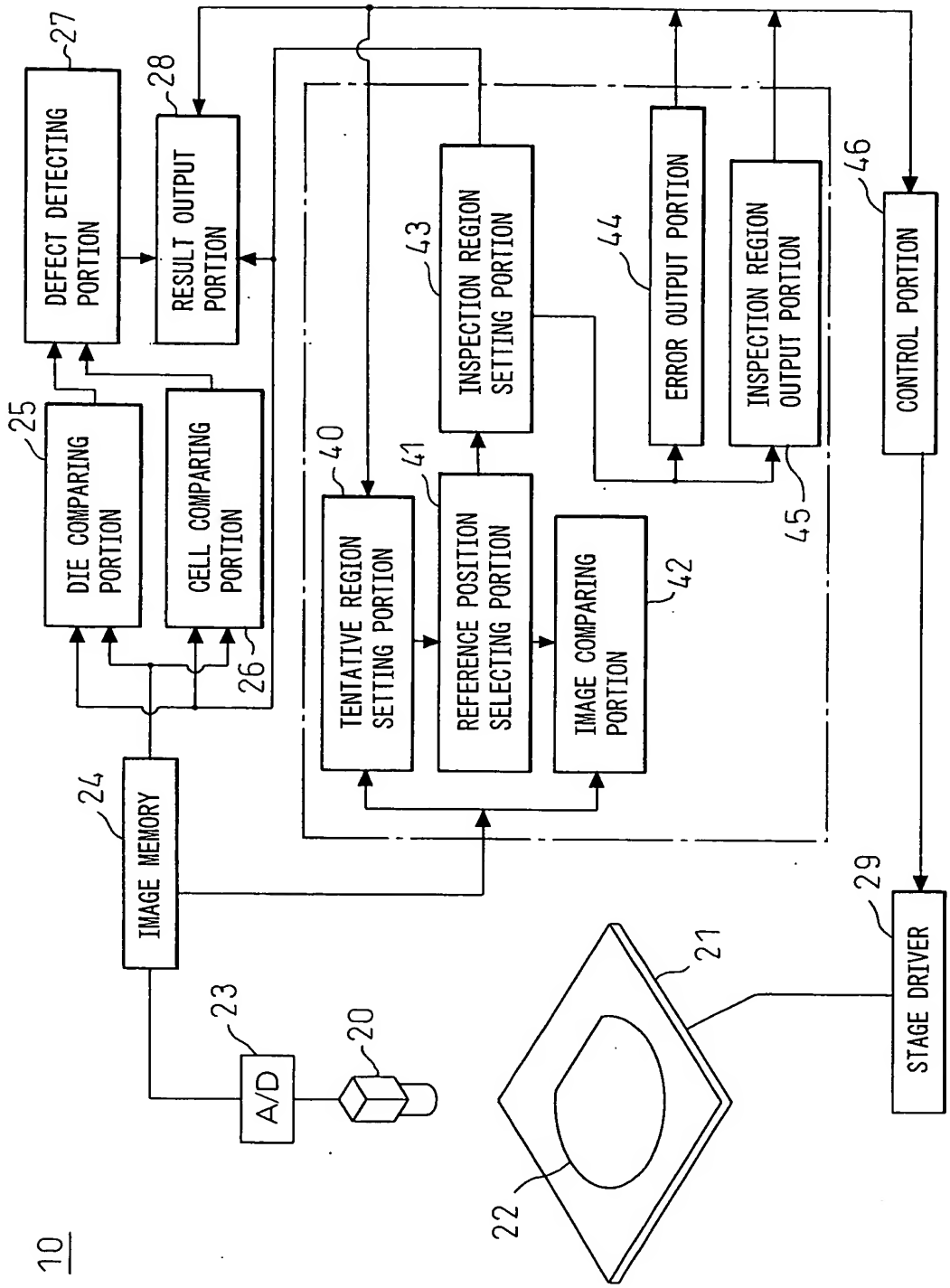

10
DEFECT DETECTING PORTION
27
RESULT OUTPUT PORTION
28
DIE COMPARING PORTION
25
CELL COMPARING PORTION
26
TENTATIVE REGION SETTING PORTION
40
REFERENCE POSITION SELECTING PORTION
41
IMAGE COMPARING PORTION
42
INSPECTION REGION SETTING PORTION
43
ERROR OUTPUT PORTION
44
INSPECTION REGION OUTPUT PORTION
45
CONTROL PORTION
46
IMAGE MEMORY
24
A/D
23
20
STAGE DRIVER
29
21
22

FIG. 5

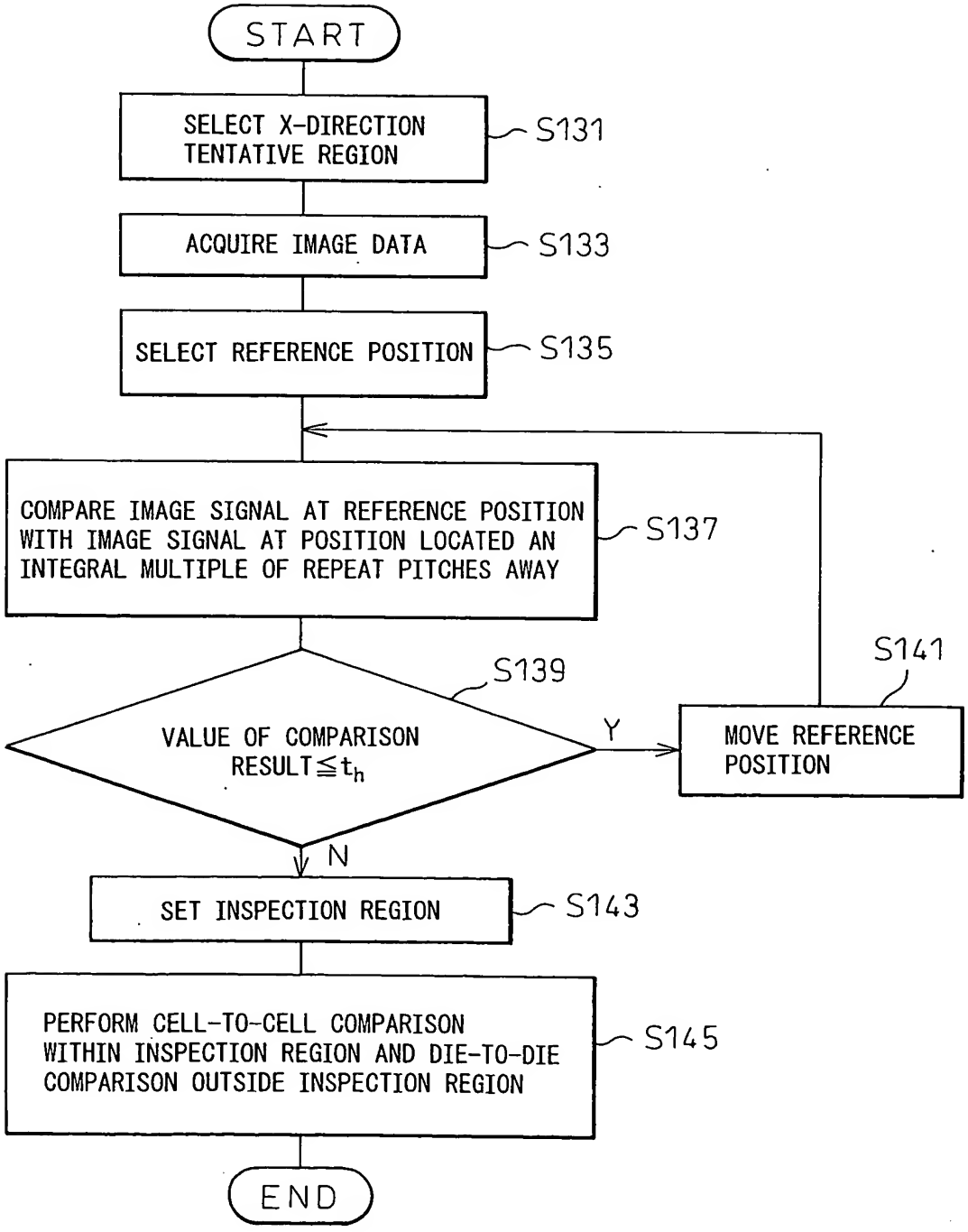

START
SELECT X-DIRECTION TENTATIVE REGION
S131
ACQUIRE IMAGE DATA
S133
SELECT REFERENCE POSITION
S135
COMPARE IMAGE SIGNAL AT REFERENCE POSITION WITH IMAGE SIGNAL AT POSITION LOCATED AN INTEGRAL MULTIPLE OF REPEAT PITCHES AWAY
S137
S139
VALUE OF COMPARISON RESULT≦t_h
Y
S141
MOVE REFERENCE POSITION
N
SET INSPECTION REGION
S143
PERFORM CELL-TO-CELL COMPARISON WITHIN INSPECTION REGION AND DIE-TO-DIE COMPARISON OUTSIDE INSPECTION REGION
S145
END

FIG. 6

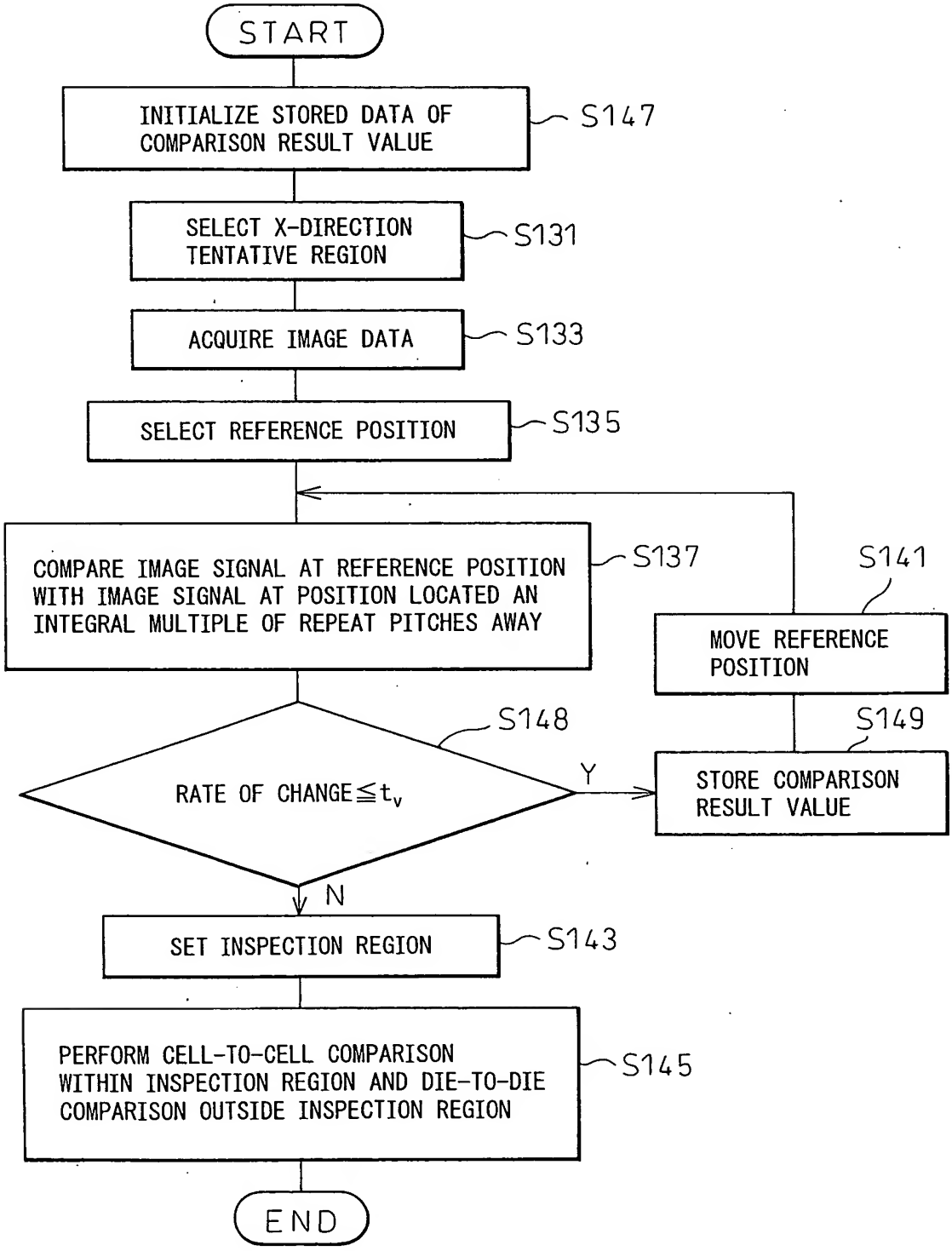

START
INITIALIZE STORED DATA OF COMPARISON RESULT VALUE
S147
SELECT X-DIRECTION TENTATIVE REGION
S131
ACQUIRE IMAGE DATA
S133
SELECT REFERENCE POSITION
S135
COMPARE IMAGE SIGNAL AT REFERENCE POSITION WITH IMAGE SIGNAL AT POSITION LOCATED AN INTEGRAL MULTIPLE OF REPEAT PITCHES AWAY
S137
S141
MOVE REFERENCE POSITION
S148
RATE OF CHANGE≦t_v
Y
S149
STORE COMPARISON RESULT VALUE
N
SET INSPECTION REGION
S143
PERFORM CELL-TO-CELL COMPARISON WITHIN INSPECTION REGION AND DIE-TO-DIE COMPARISON OUTSIDE INSPECTION REGION
S145
END

FIG.7

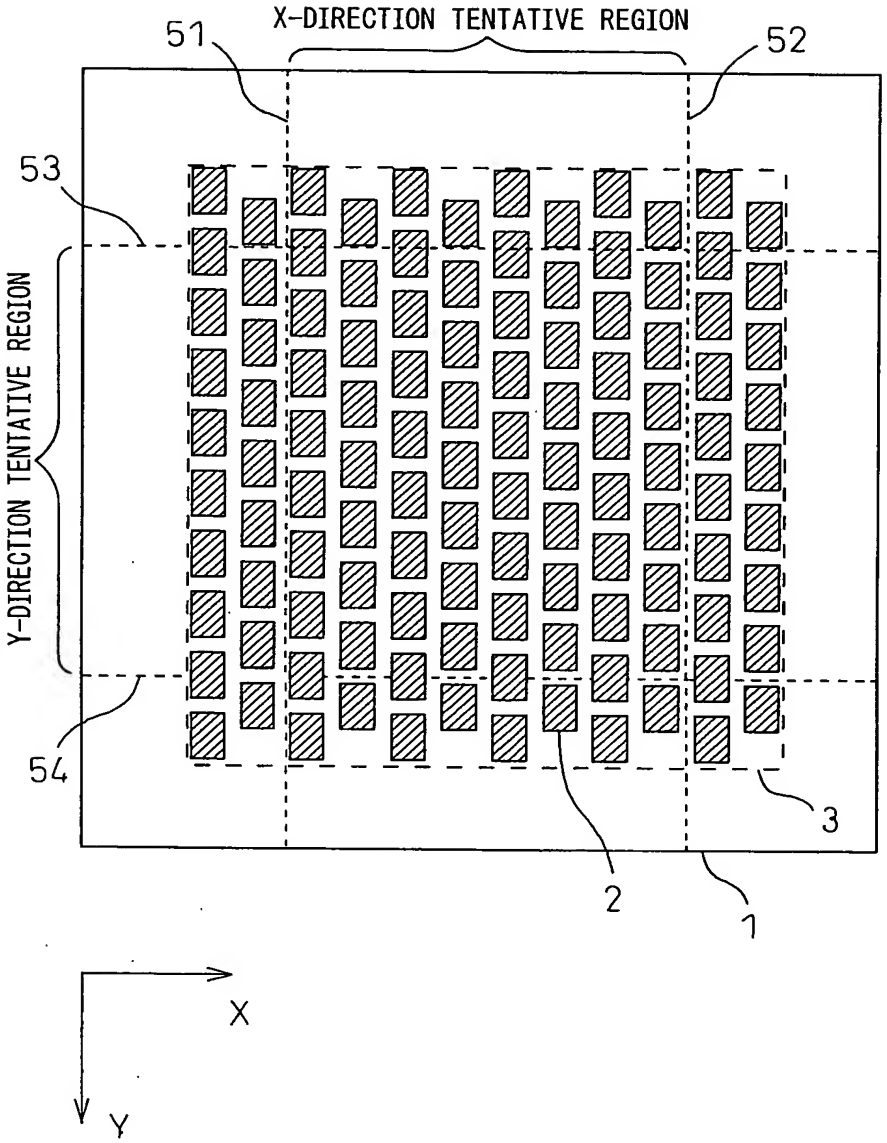

X-DIRECTION TENTATIVE REGION
51
52
53
Y-DIRECTION TENTATIVE REGION
54
3
2
1
X
Y

FIG.8

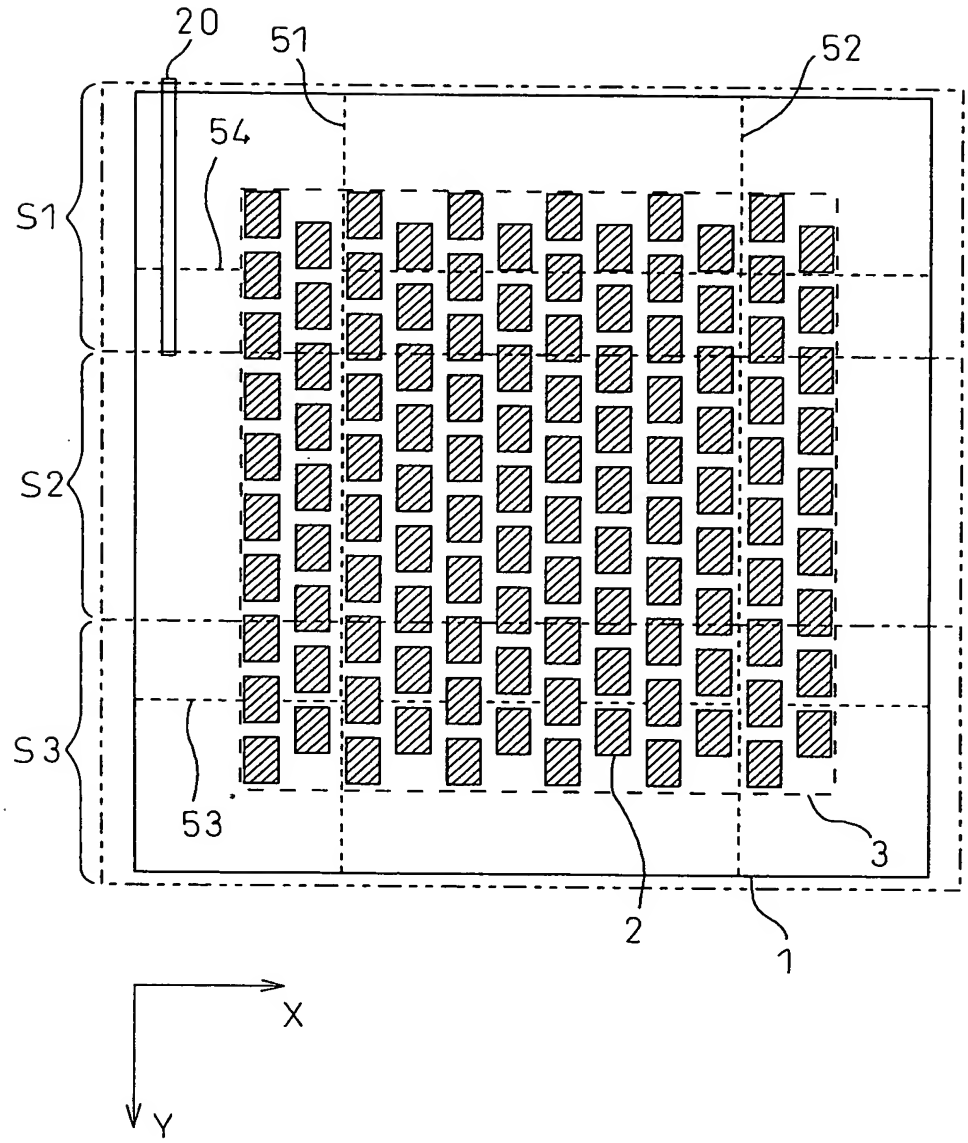


FIG.9A

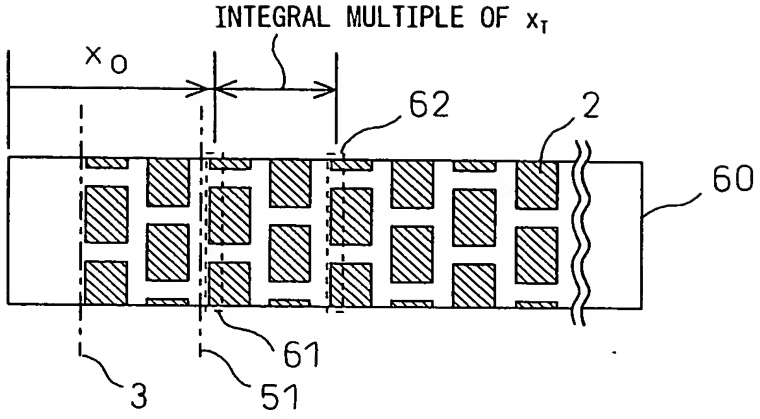


FIG.9B

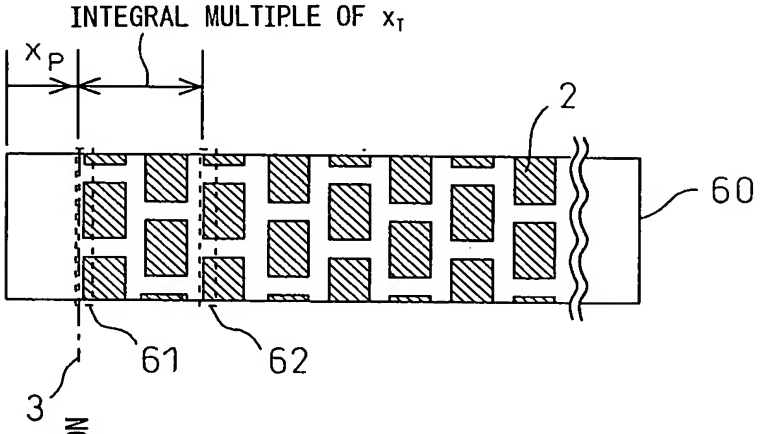


FIG.9C

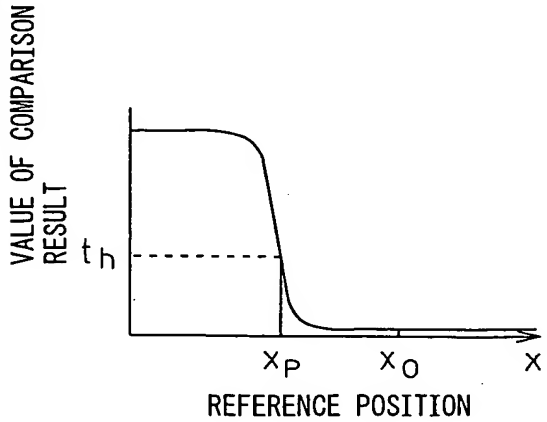


FIG. 10A

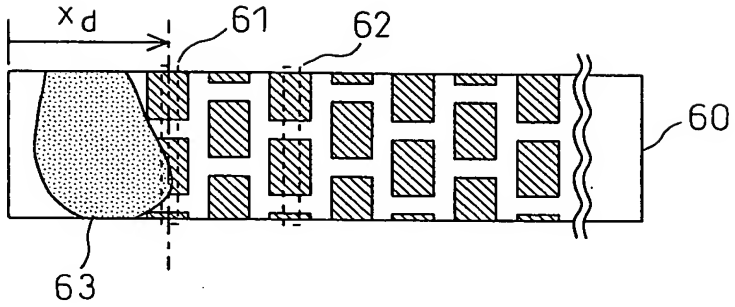


FIG. 10B

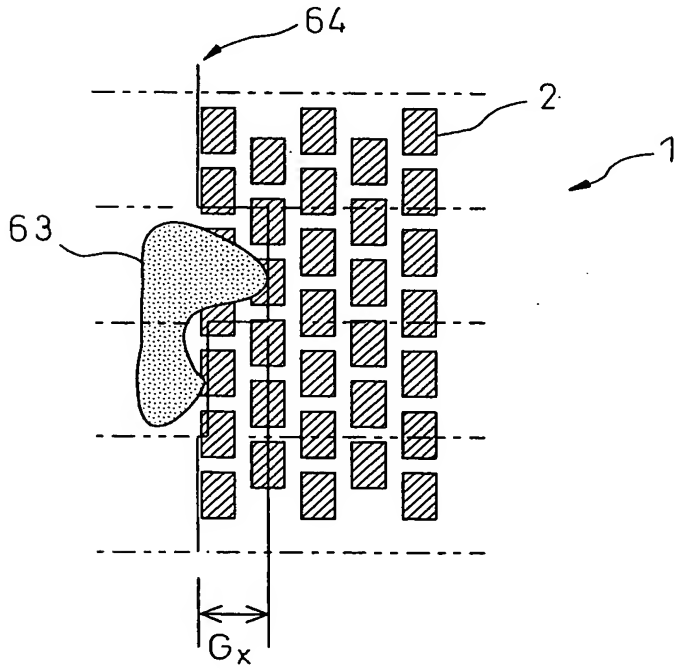


FIG.11

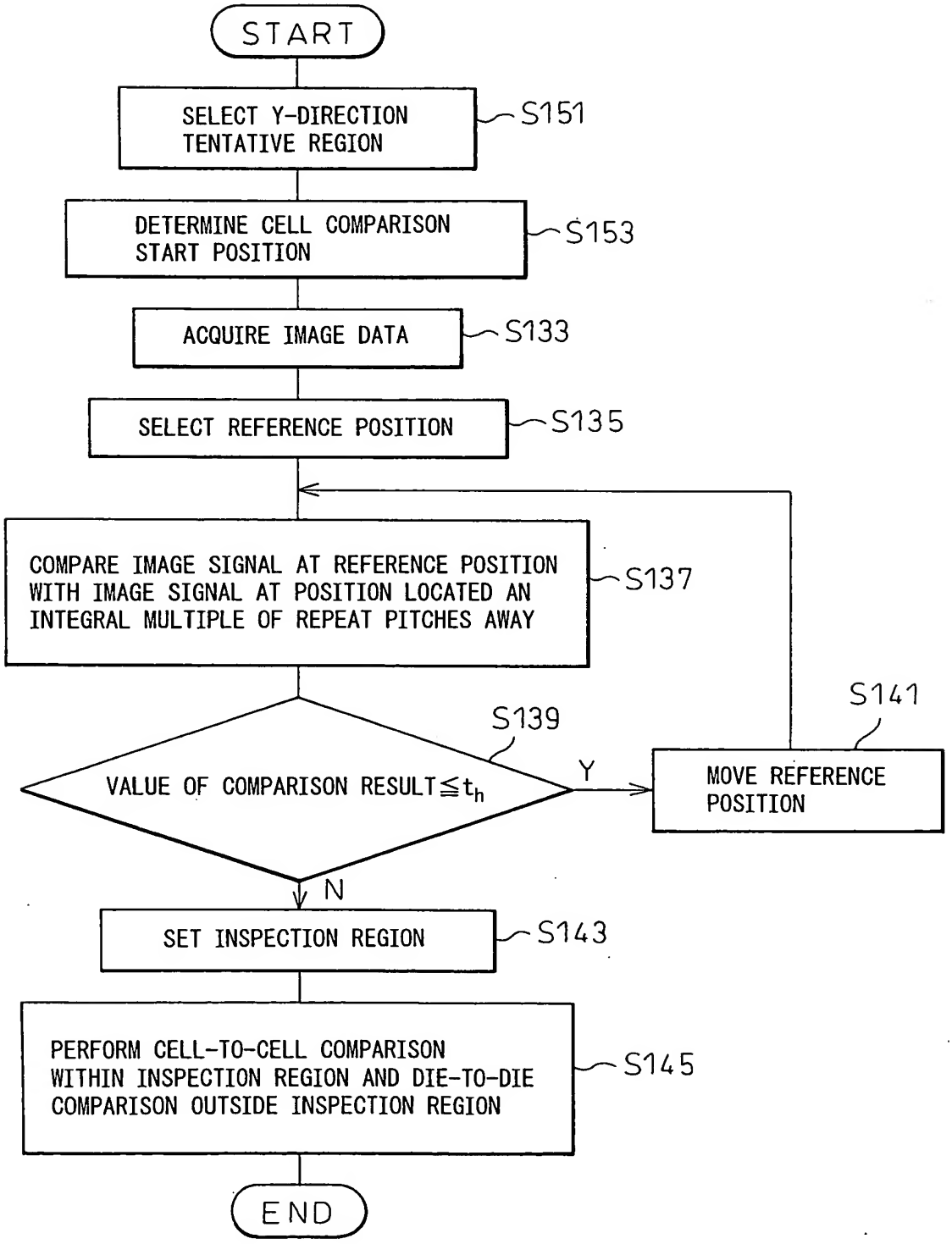

START
SELECT Y-DIRECTION TENTATIVE REGION
S151
DETERMINE CELL COMPARISON START POSITION
S153
ACQUIRE IMAGE DATA
S133
SELECT REFERENCE POSITION
S135
COMPARE IMAGE SIGNAL AT REFERENCE POSITION WITH IMAGE SIGNAL AT POSITION LOCATED AN INTEGRAL MULTIPLE OF REPEAT PITCHES AWAY
S137
S139
VALUE OF COMPARISON RESULT ≦ t_h
Y
S141
MOVE REFERENCE POSITION
N
SET INSPECTION REGION
S143
PERFORM CELL-TO-CELL COMPARISON WITHIN INSPECTION REGION AND DIE-TO-DIE COMPARISON OUTSIDE INSPECTION REGION
S145
END

FIG.12

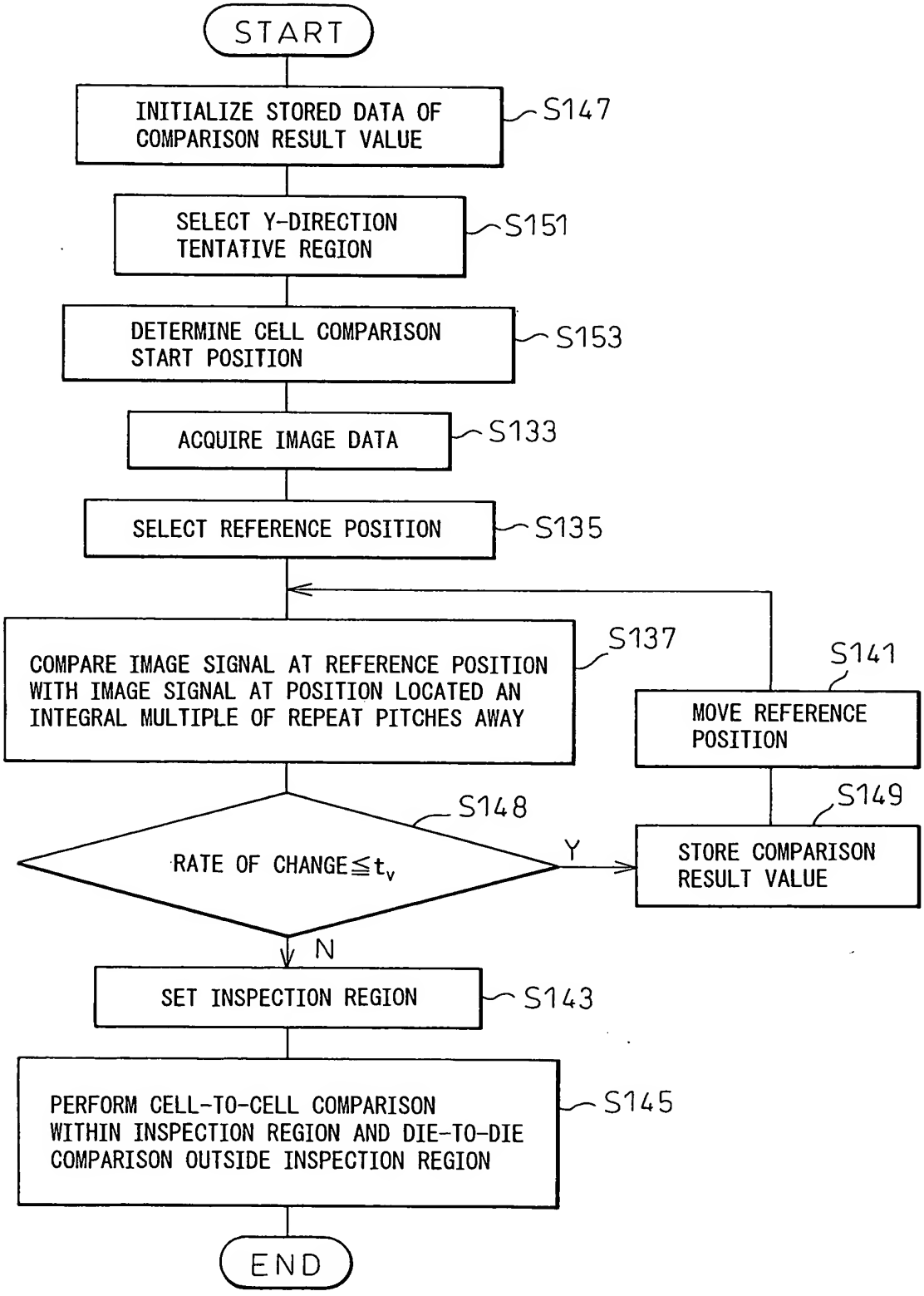

START
INITIALIZE STORED DATA OF COMPARISON RESULT VALUE
S147
SELECT Y-DIRECTION TENTATIVE REGION
S151
DETERMINE CELL COMPARISON START POSITION
S153
ACQUIRE IMAGE DATA
S133
SELECT REFERENCE POSITION
S135
COMPARE IMAGE SIGNAL AT REFERENCE POSITION WITH IMAGE SIGNAL AT POSITION LOCATED AN INTEGRAL MULTIPLE OF REPEAT PITCHES AWAY
S137
S141
MOVE REFERENCE POSITION
S148
RATE OF CHANGE≦t_v
Y
S149
STORE COMPARISON RESULT VALUE
N
SET INSPECTION REGION
S143
PERFORM CELL-TO-CELL COMPARISON WITHIN INSPECTION REGION AND DIE-TO-DIE COMPARISON OUTSIDE INSPECTION REGION
S145
END

FIG. 13A

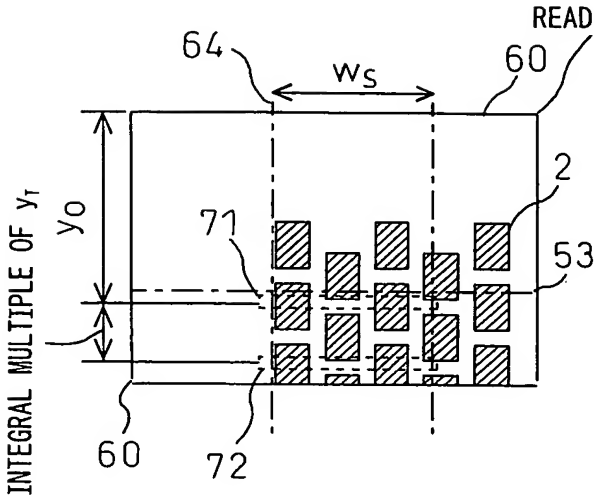


FIG. 13B

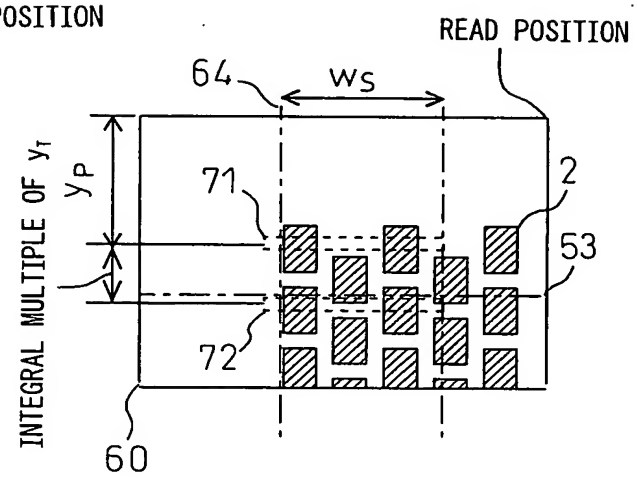


FIG. 13C

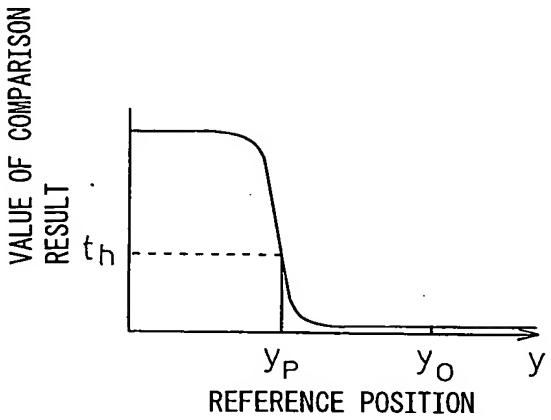


FIG. 13D

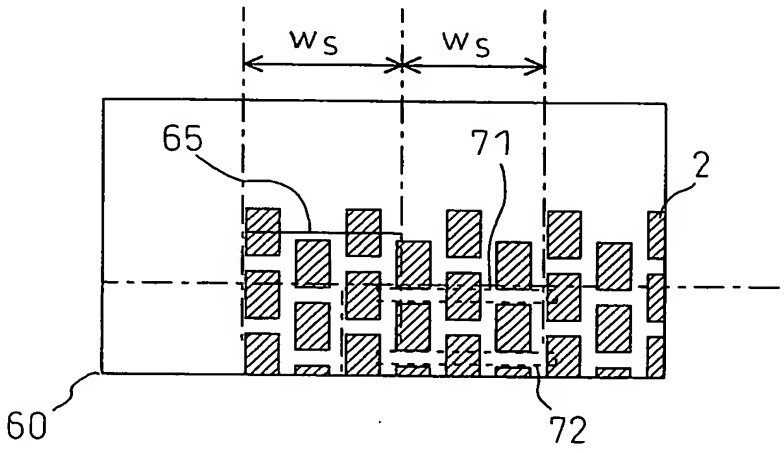


FIG.14

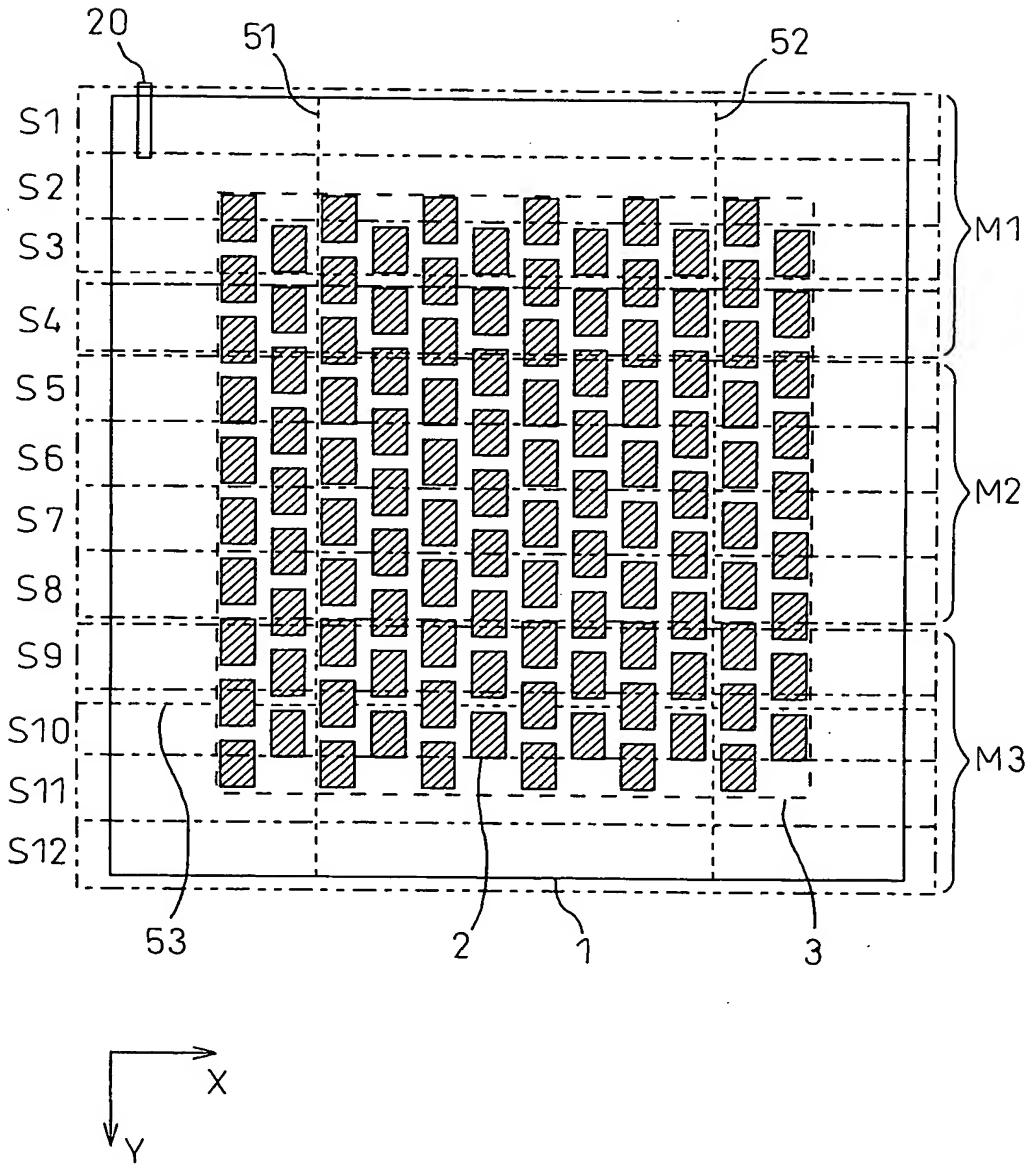


FIG.15

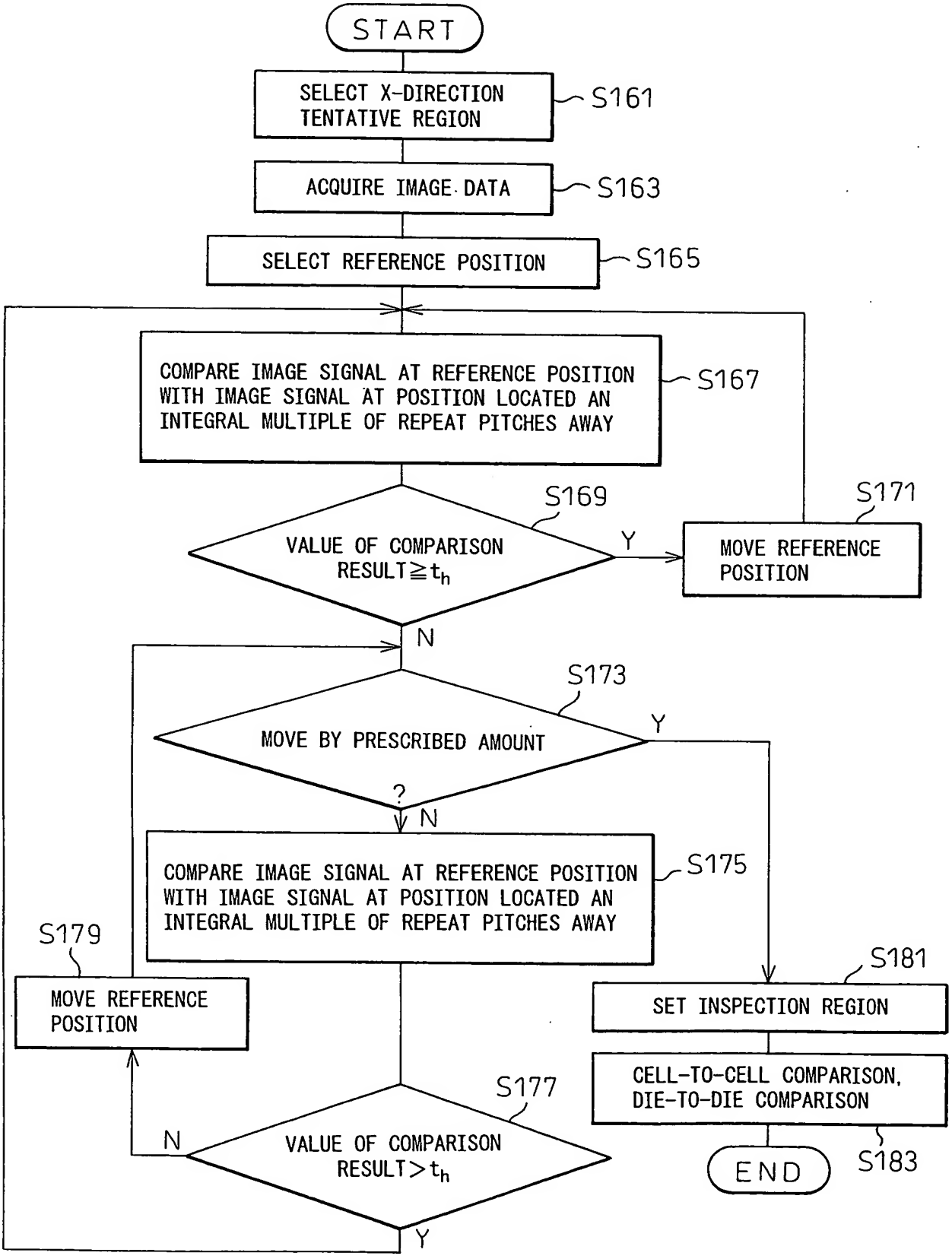

START
SELECT X-DIRECTION TENTATIVE REGION
S161
ACQUIRE IMAGE DATA
S163
SELECT REFERENCE POSITION
S165
COMPARE IMAGE SIGNAL AT REFERENCE POSITION WITH IMAGE SIGNAL AT POSITION LOCATED AN INTEGRAL MULTIPLE OF REPEAT PITCHES AWAY
S167
S169
VALUE OF COMPARISON RESULT≧t_h
Y
S171
MOVE REFERENCE POSITION
N
S173
MOVE BY PRESCRIBED AMOUNT
Y
?
N
COMPARE IMAGE SIGNAL AT REFERENCE POSITION WITH IMAGE SIGNAL AT POSITION LOCATED AN INTEGRAL MULTIPLE OF REPEAT PITCHES AWAY
S175
S179
MOVE REFERENCE POSITION
S181
SET INSPECTION REGION
CELL-TO-CELL COMPARISON, DIE-TO-DIE COMPARISON
S177
N
VALUE OF COMPARISON RESULT>t_h
Y
END
S183

FIG.16

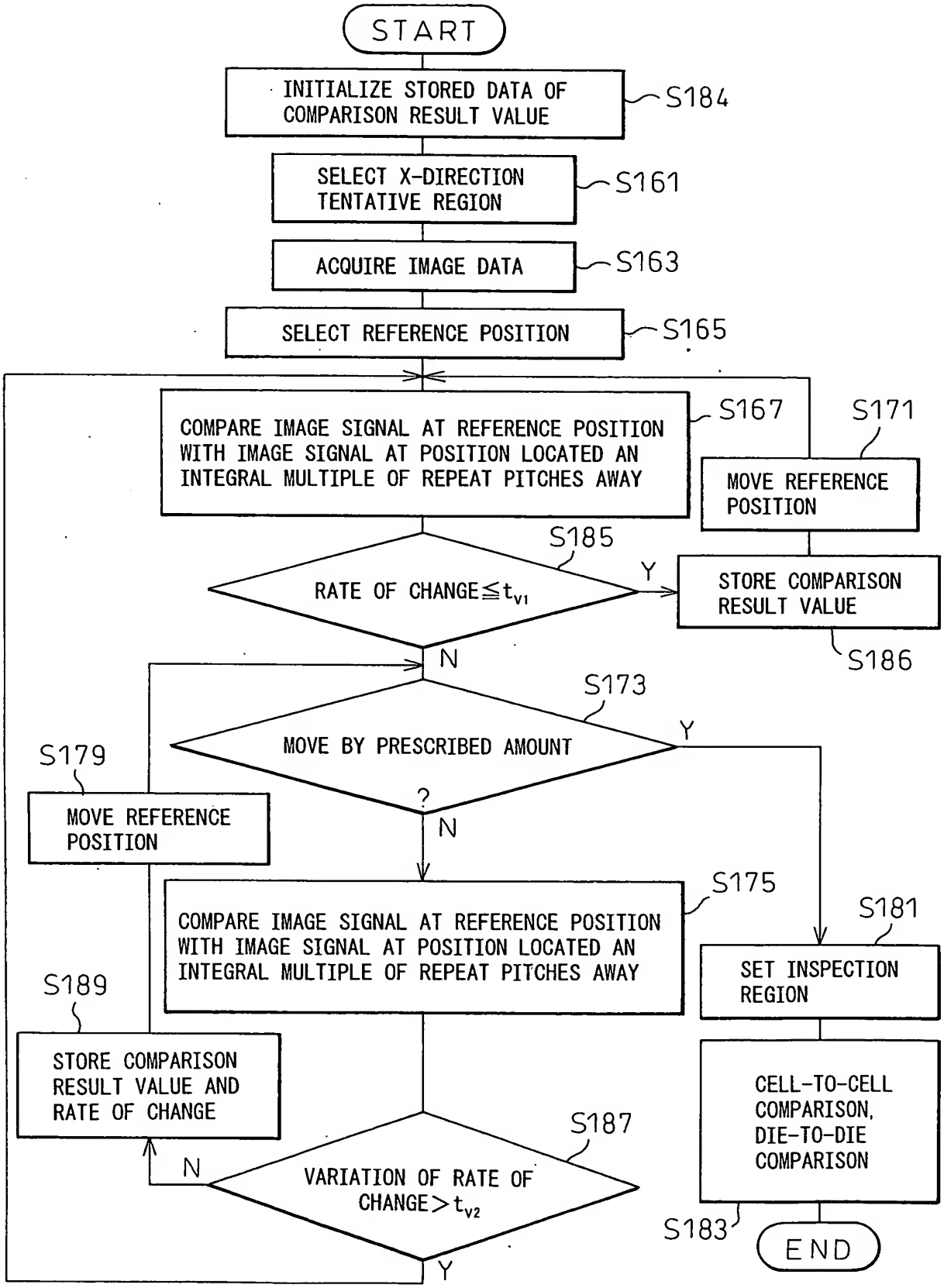

START
INITIALIZE STORED DATA OF COMPARISON RESULT VALUE
S184
SELECT X-DIRECTION TENTATIVE REGION
S161
ACQUIRE IMAGE DATA
S163
SELECT REFERENCE POSITION
S165
COMPARE IMAGE SIGNAL AT REFERENCE POSITION WITH IMAGE SIGNAL AT POSITION LOCATED AN INTEGRAL MULTIPLE OF REPEAT PITCHES AWAY
S167
S171
MOVE REFERENCE POSITION
S185
RATE OF CHANGE≦t_{v1}
Y
STORE COMPARISON RESULT VALUE
S186
N
S173
MOVE BY PRESCRIBED AMOUNT
Y
?
N
S179
MOVE REFERENCE POSITION
S175
COMPARE IMAGE SIGNAL AT REFERENCE POSITION WITH IMAGE SIGNAL AT POSITION LOCATED AN INTEGRAL MULTIPLE OF REPEAT PITCHES AWAY
S181
SET INSPECTION REGION
S189
STORE COMPARISON RESULT VALUE AND RATE OF CHANGE
CELL-TO-CELL COMPARISON, DIE-TO-DIE COMPARISON
S187
N
VARIATION OF RATE OF CHANGE>t_{v2}
Y
S183
END

FIG.17

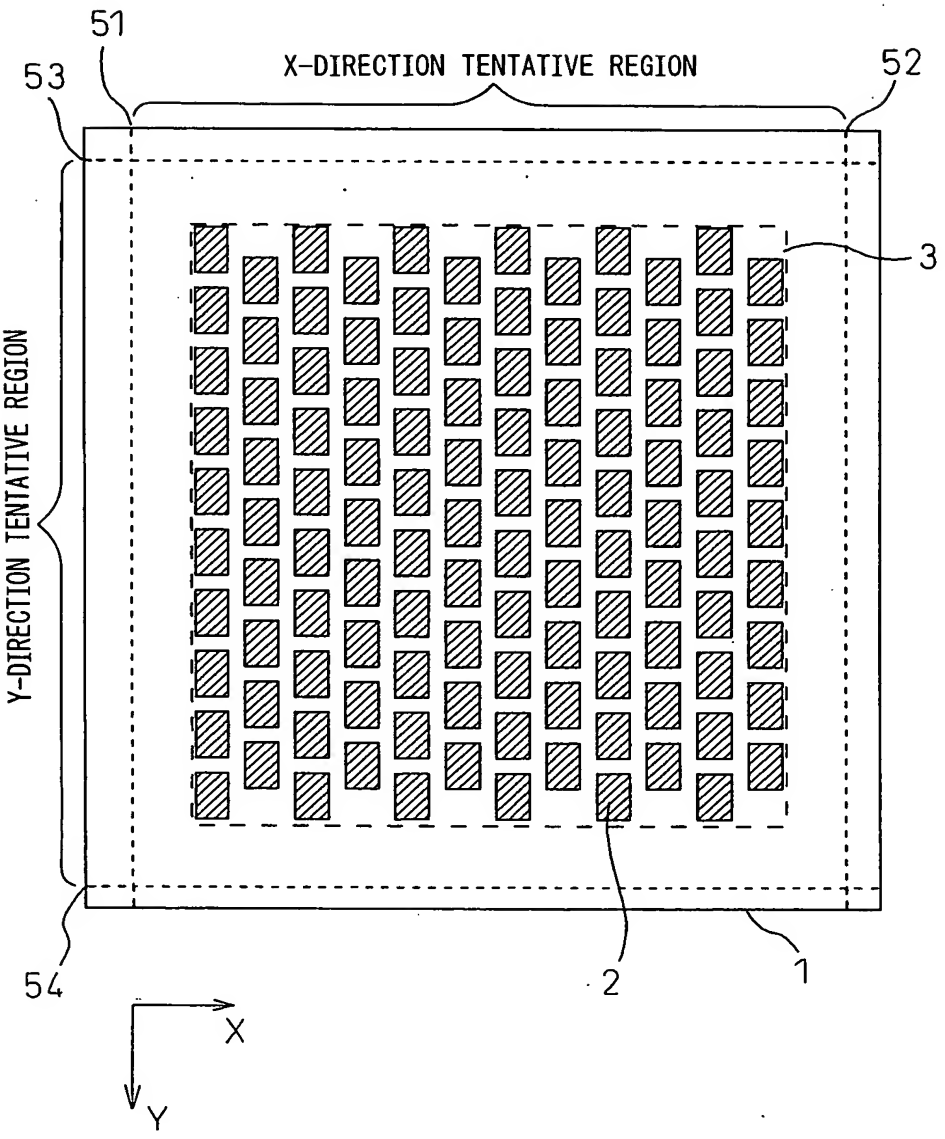

51
X-DIRECTION TENTATIVE REGION
52
53
3
Y-DIRECTION TENTATIVE REGION
54
2
1
X
Y

FIG.18A

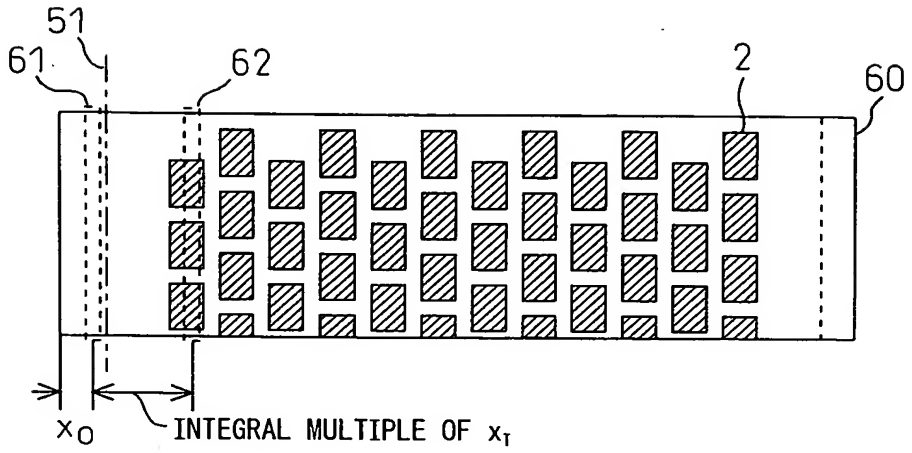


FIG.18B

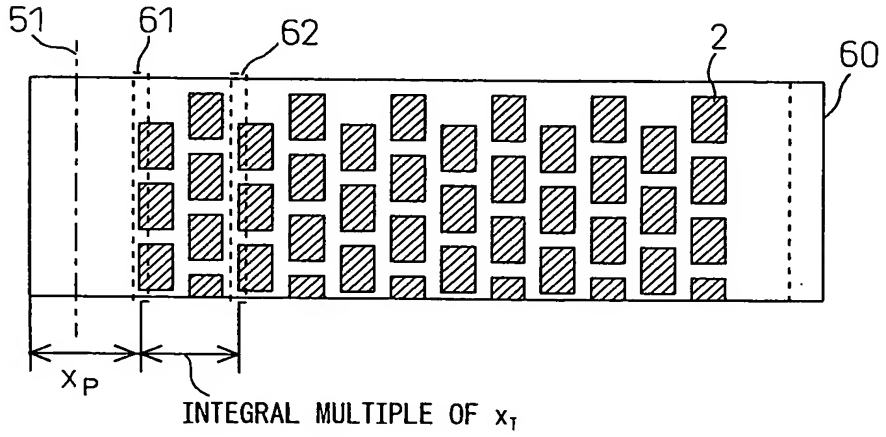


FIG.18C

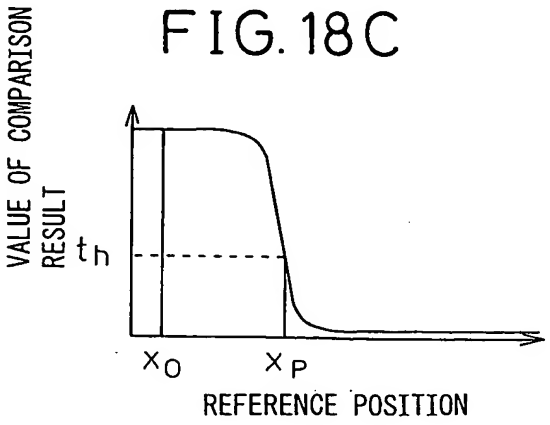


FIG.19A

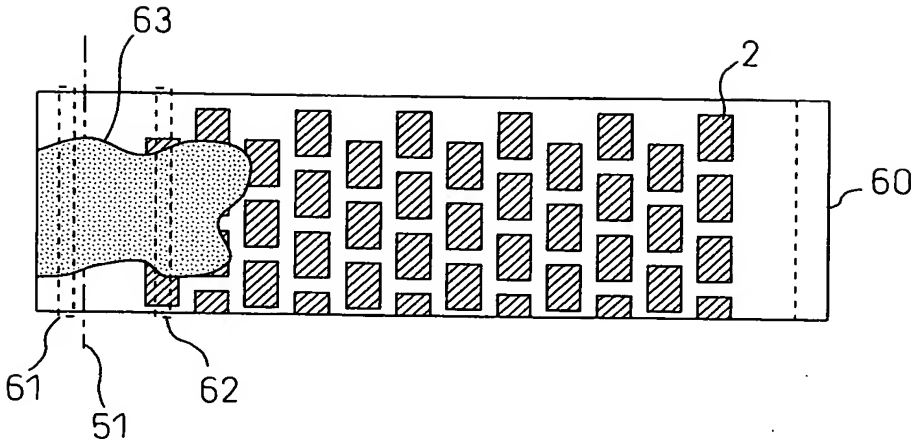


FIG.19B

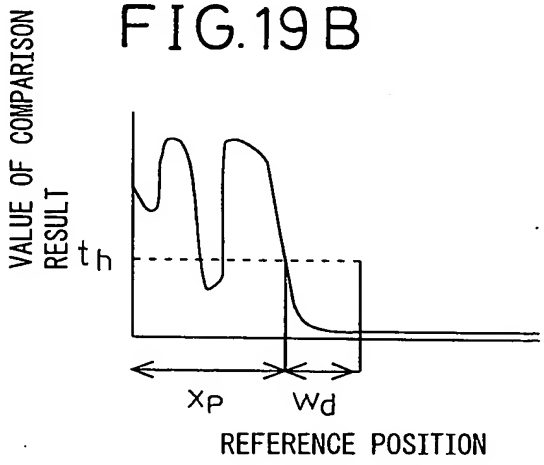


FIG.20

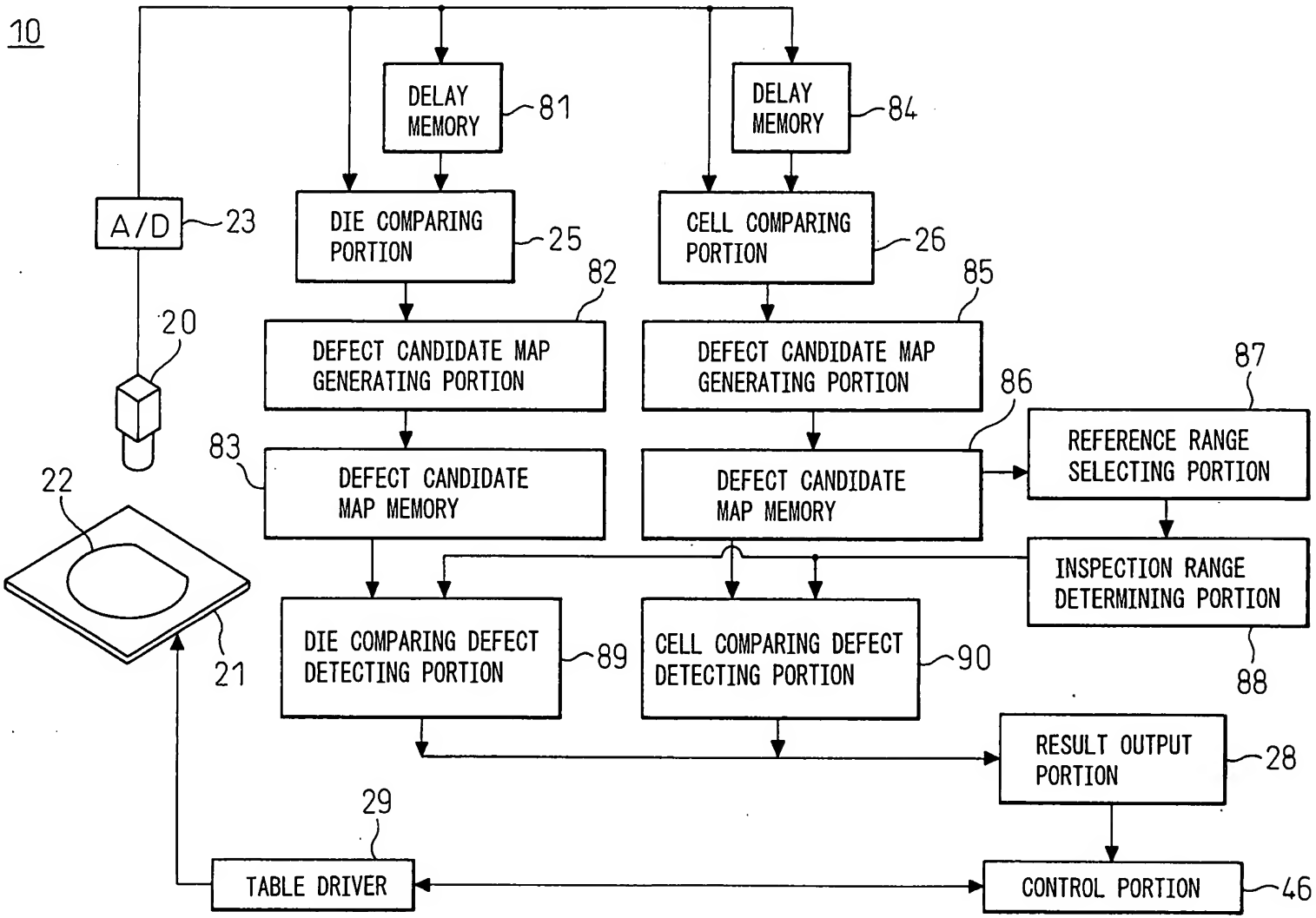

10
DELAY MEMORY
81
DELAY MEMORY
84
A/D
23
DIE COMPARING PORTION
25
CELL COMPARING PORTION
26
82
85
20
DEFECT CANDIDATE MAP GENERATING PORTION
DEFECT CANDIDATE MAP GENERATING PORTION
87
86
83
DEFECT CANDIDATE MAP MEMORY
DEFECT CANDIDATE MAP MEMORY
REFERENCE RANGE SELECTING PORTION
22
INSPECTION RANGE DETERMINING PORTION
DIE COMPARING DEFECT DETECTING PORTION
89
CELL COMPARING DEFECT DETECTING PORTION
90
21
88
RESULT OUTPUT PORTION
28
29
TABLE DRIVER
CONTROL PORTION
46

FIG.21

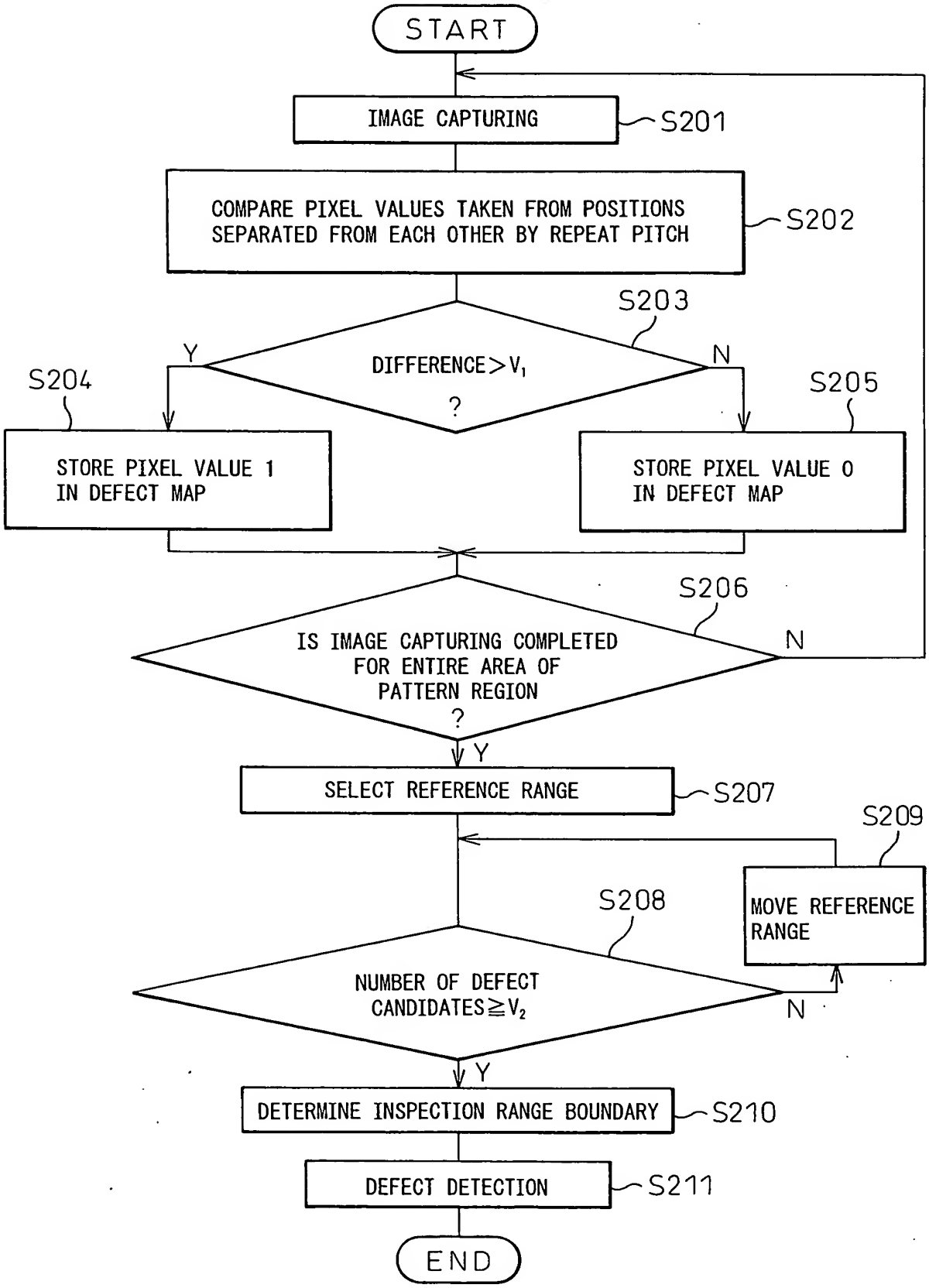

START
IMAGE CAPTURING
S201
COMPARE PIXEL VALUES TAKEN FROM POSITIONS SEPARATED FROM EACH OTHER BY REPEAT PITCH
S202
S203
DIFFERENCE>V1 ?
Y
N
S204
STORE PIXEL VALUE 1 IN DEFECT MAP
S205
STORE PIXEL VALUE 0 IN DEFECT MAP
S206
IS IMAGE CAPTURING COMPLETED FOR ENTIRE AREA OF PATTERN REGION ?
N
Y
SELECT REFERENCE RANGE
S207
S209
MOVE REFERENCE RANGE
S208
NUMBER OF DEFECT CANDIDATES≧V2
N
Y
DETERMINE INSPECTION RANGE BOUNDARY
S210
DEFECT DETECTION
S211
END

FIG.22A

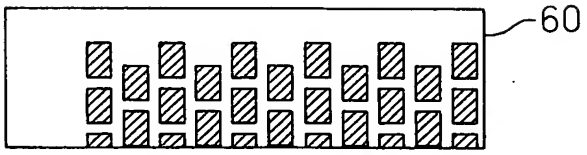


FIG.22B

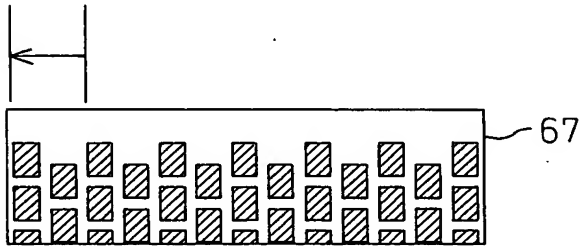


FIG.22C

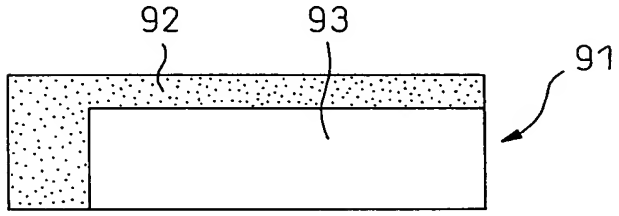


FIG.22D

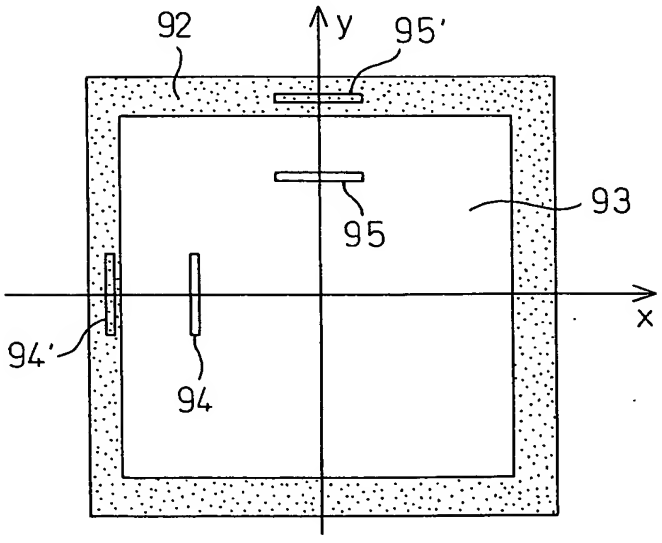


FIG.23A

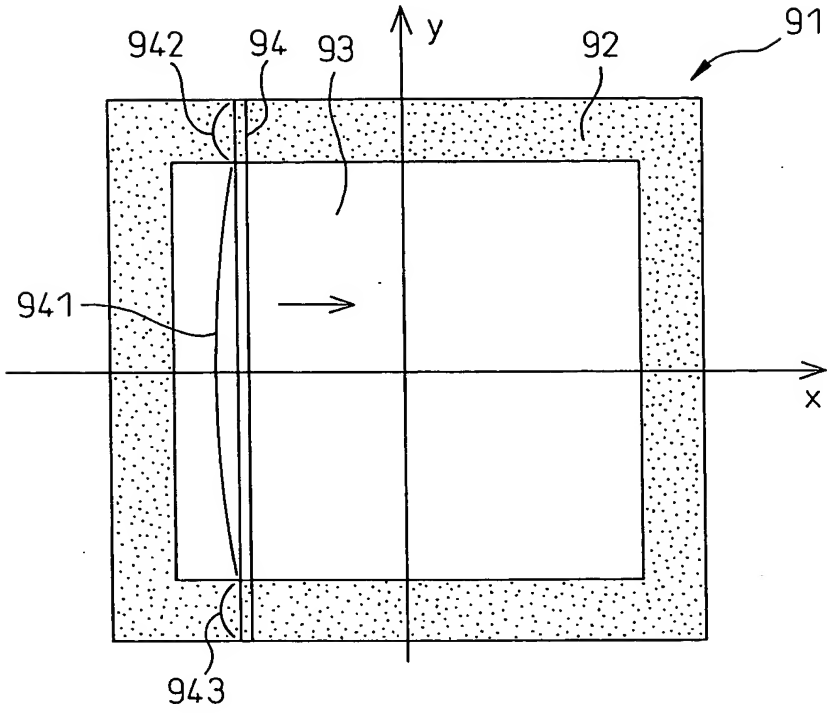


FIG.23B

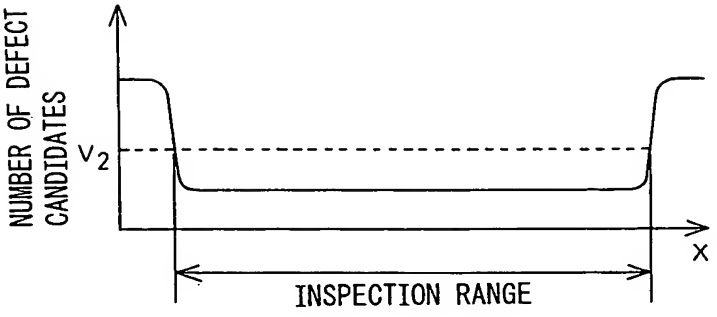


FIG.24

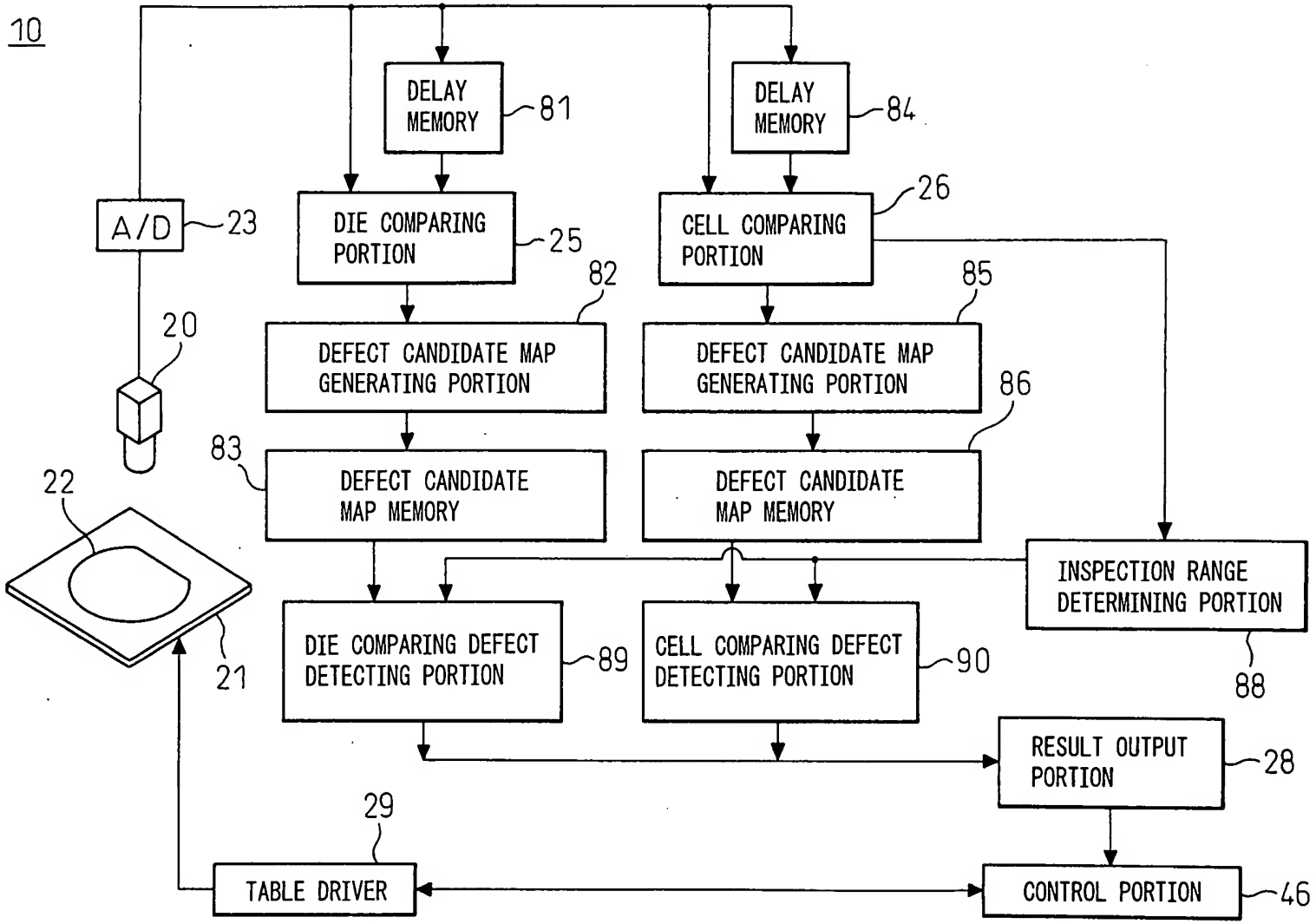

10
DELAY MEMORY
81
DELAY MEMORY
84
A/D
23
DIE COMPARING PORTION
25
CELL COMPARING PORTION
26
82
85
20
DEFECT CANDIDATE MAP GENERATING PORTION
DEFECT CANDIDATE MAP GENERATING PORTION
86
83
DEFECT CANDIDATE MAP MEMORY
DEFECT CANDIDATE MAP MEMORY
22
INSPECTION RANGE DETERMINING PORTION
21
DIE COMPARING DEFECT DETECTING PORTION
89
CELL COMPARING DEFECT DETECTING PORTION
90
88
RESULT OUTPUT PORTION
28
29
TABLE DRIVER
CONTROL PORTION
46

FIG.25

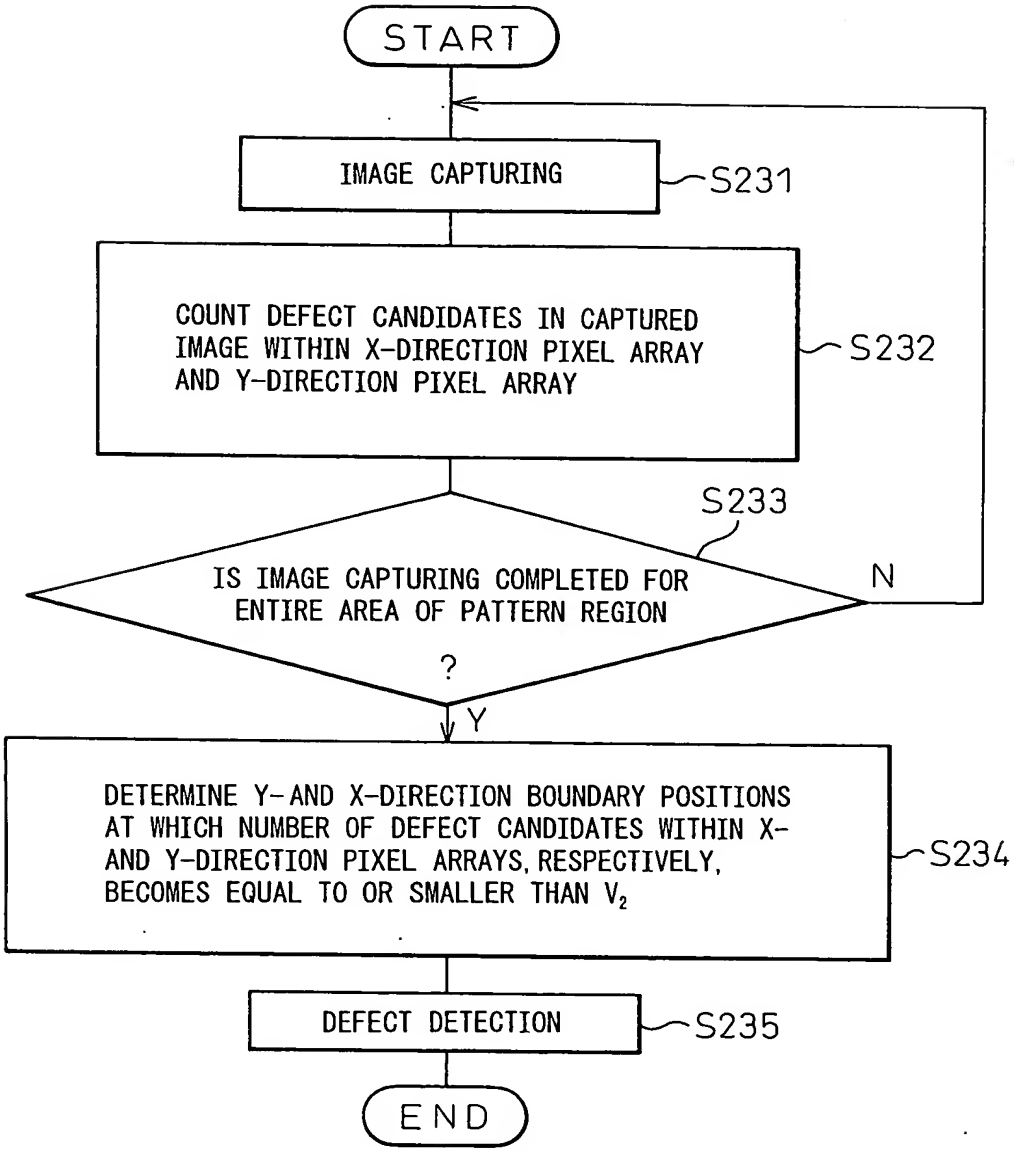

START
IMAGE CAPTURING
S231
COUNT DEFECT CANDIDATES IN CAPTURED IMAGE WITHIN X-DIRECTION PIXEL ARRAY AND Y-DIRECTION PIXEL ARRAY
S232
S233
IS IMAGE CAPTURING COMPLETED FOR ENTIRE AREA OF PATTERN REGION ?
N
Y
DETERMINE Y- AND X-DIRECTION BOUNDARY POSITIONS AT WHICH NUMBER OF DEFECT CANDIDATES WITHIN X- AND Y-DIRECTION PIXEL ARRAYS, RESPECTIVELY, BECOMES EQUAL TO OR SMALLER THAN V_2
S234
DEFECT DETECTION
S235
END

FIG.26

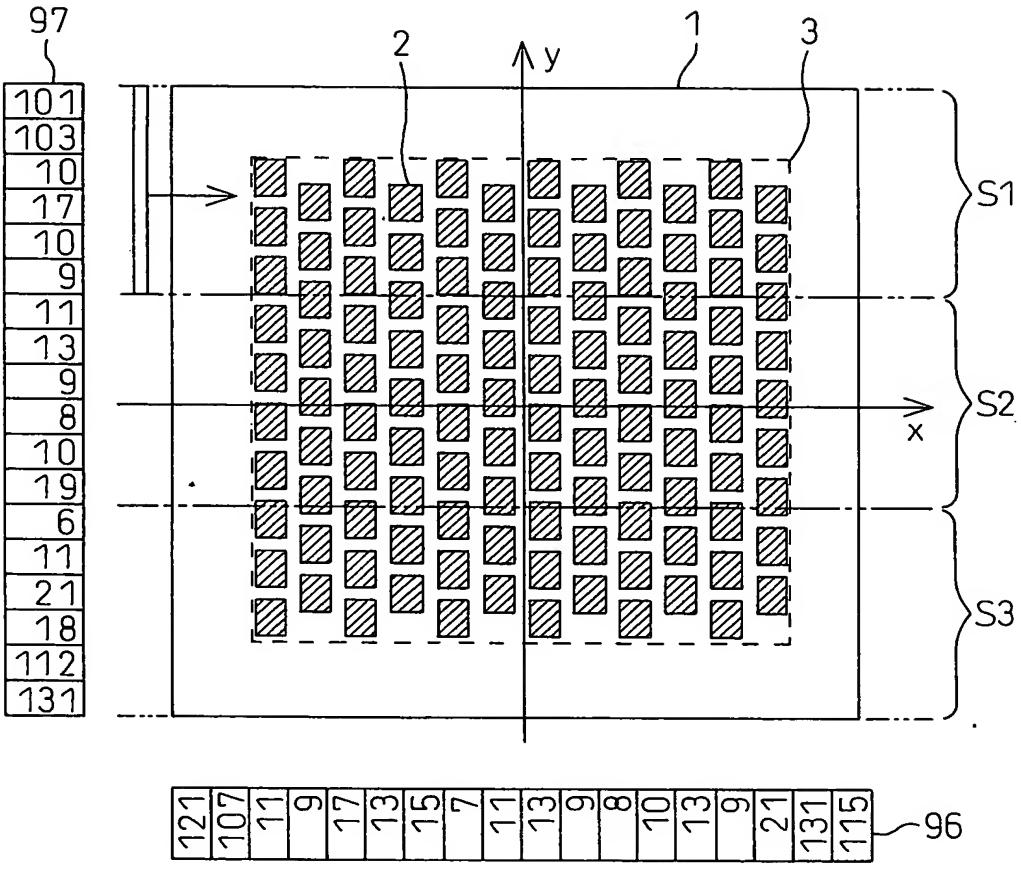

97
101
103
10
17
10
9
11
13
9
8
10
19
6
11
21
18
112
131
2
y
1
3
S1
S2
S3
x
121
107
11
9
17
13
15
7
11
13
9
8
10
13
9
21
131
115
96

FIG. 27

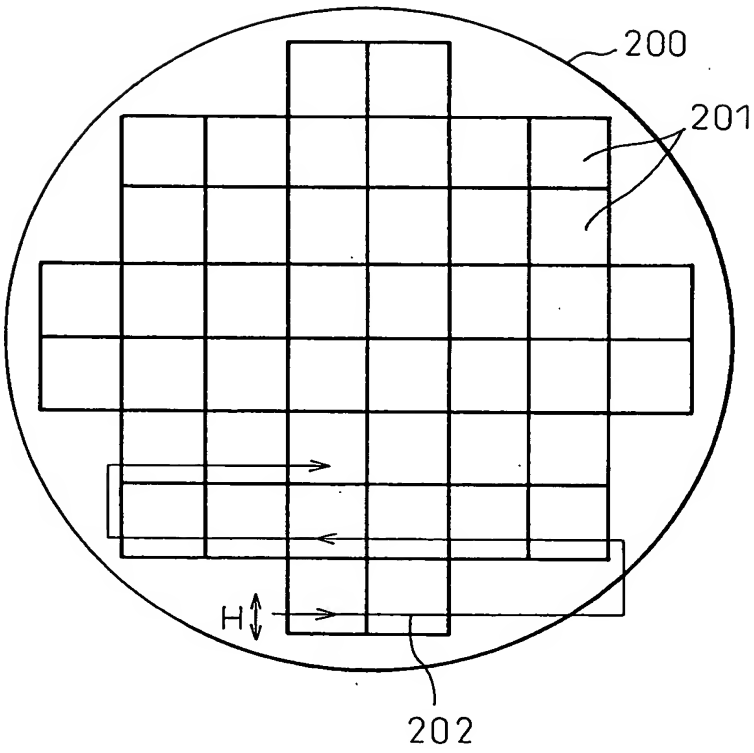


FIG. 28

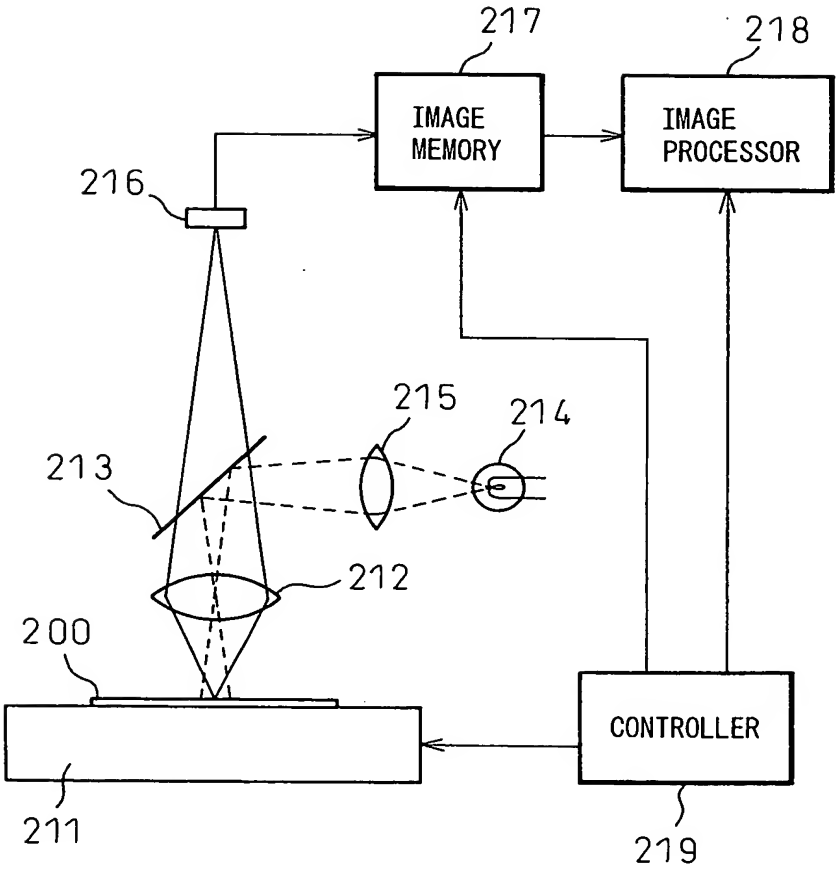

217
218
IMAGE MEMORY
IMAGE PROCESSOR
216
215
214
213
212
200
CONTROLLER
211
219

FIG. 29

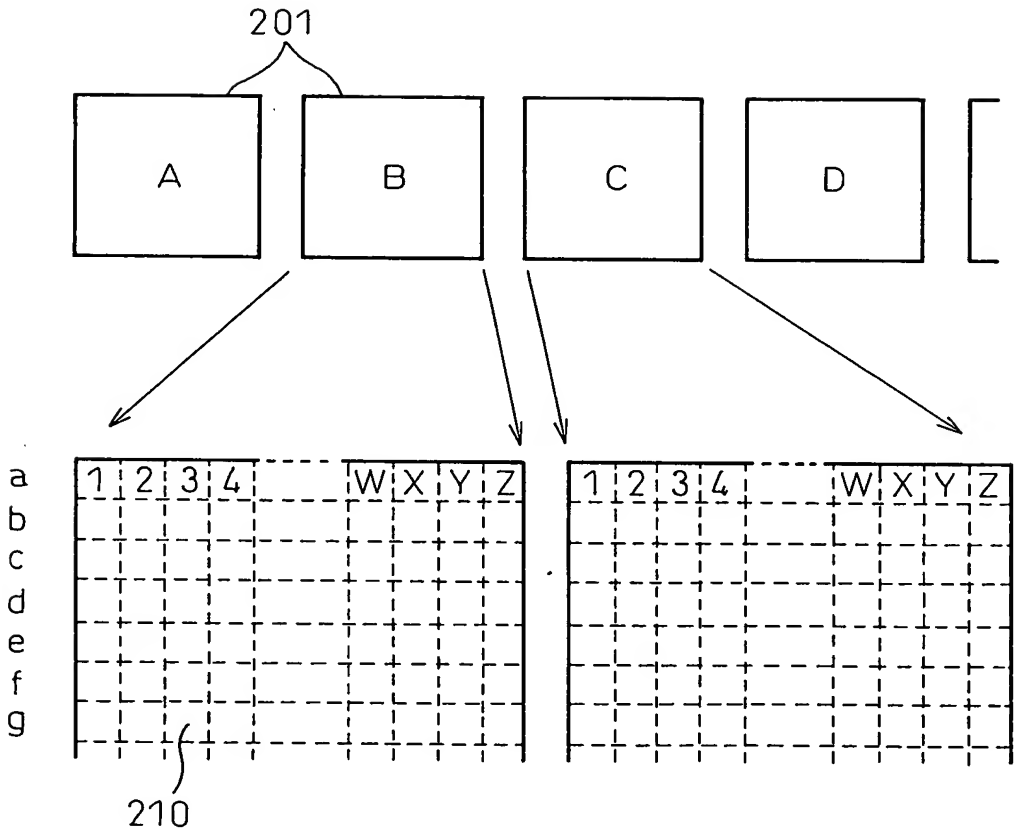
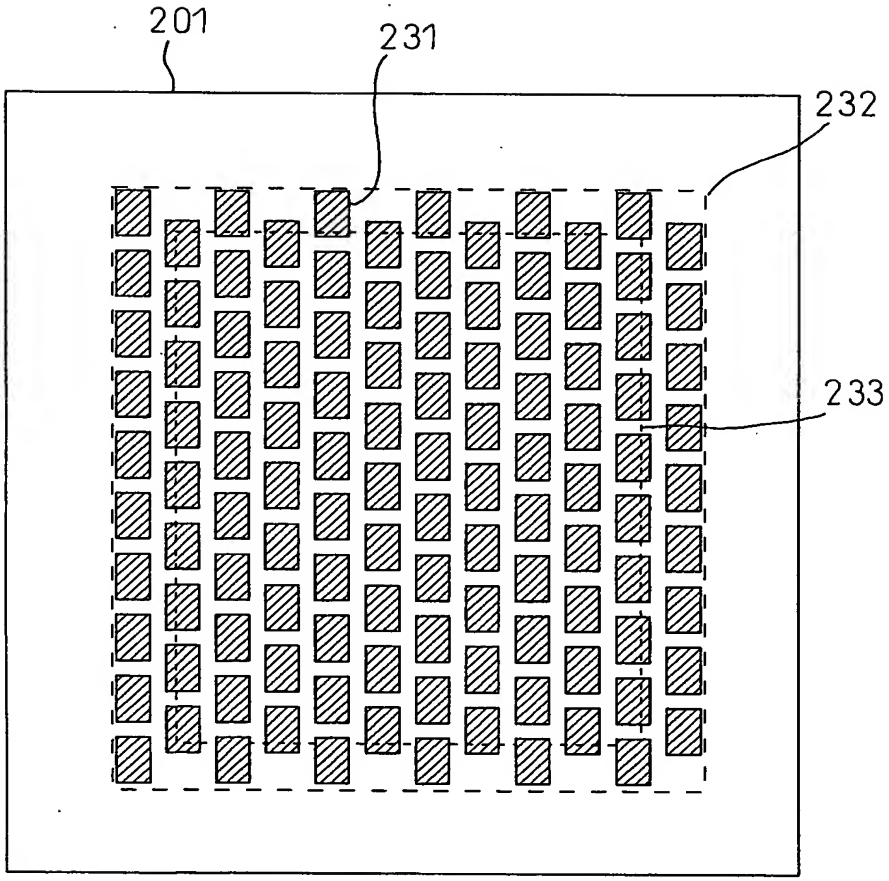


FIG. 30



DESCRIPTION OF THE REFERENCE NUMERALS

1 ... DIE

2 ... REPEATED PATTERN (CELL)

3 ... REPEATED PATTERN REGION

4, 5 ... PIXEL BLOCK

20 ... IMAGING PORTION

21 ... STAGE

22 ... WAFER

23 ... A/D CONVERTER

24 ... IMAGE MEMORY

25 ... DIE COMPARING PORTION

26 ... CELL COMPARING PORTION

27 ... DEFECT DETECTING PORTION

28 ... RESULT OUTPUT PORTION

29 ... STAGE DRIVER

40 ... TENTATIVE REGION SETTING PORTION

41 ... REFERENCE POSITION SELECTING PORTION

42 ... IMAGE COMPARING PORTION

43 ... INSPECTION REGION SETTING PORTION

44 ... ERROR OUTPUT PORTION

45 ... INSPECTION REGION OUTPUT PORTION